

Logarithms

Logarithm of y with base b .

$\log_b y = x$ Read as "log base b of y ."

$\log_2 8 = 3$ What power of 2 equals 8?
 $2^? = 8$ $2^3 = 8$

$\log_4 1 = 0$ What power of 4 equals 1?
 $4^? = 1$ $4^0 = 1$

$\log_4 1/4 = -1$ What power of 4 equals $1/4$?
 $4^? = 1/4$ $4^{-1} = 1/4$

$\log_3 81 = 4$ What power of 3 equals 81?
 $3^? = 81$

Why we need logs:

$$\begin{aligned} 3^1 &= 3 \\ 3^2 &= 9 \\ 3^3 &= 27 \end{aligned}$$

$$\log_b y = x$$

↑ "answer"
↑ base ↑ exponent
 $b^x = y$

Rewrite the equation in exponential form.

a. $\log_2 32 = 5$ $2^5 = 32$

b. $\log_{10} 1 = 0$ $10^0 = 1$

c. $\log_9 9 = 1$ $9^1 = 9$

d. $\log_{1/5} 25 = -2$ $(1/5)^{-2} = 25$

Evaluate the logarithm.

a. $\log_3 81 = 4$ $3^4 = 81$

b. $\log_{1/4} 256 = -4$ $(1/4)^{-4} = 256$

c. $\log_{10} 0.001 = -3$ $10^{-3} = .001 = \frac{1}{1000} = \frac{1}{10^3}$

d. $\log_{64} 2 = 1/6$ $64^{1/6} = 2$

e. $\log_9 (1/3) = -1/2$ $9^{-1/2} = 1/3$ $64^{1/6} = 2$

$$\begin{aligned} 9^{1/2} &= 3 \\ 9^{-1/2} &= \frac{1}{3} \end{aligned}$$